NUI Galway
OÉ Gaillimh

Autumn Examinations 2011/ 2012

Exam Code(s)	3IF1
Exam(s)	Third Year Examination in Information Technology

Module Code(s)	CT332
Module(s)	Database Systems II

Paper No.
Repeat Paper

Discipline(s)	Information Technology
Course Co-ordinator(s)	
Internal Examiner(s)	Professor G. Lyons
	Dr. M. Madden
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External Examiner(s)	Professor M. O'Boyle

No. of Pages	3
Duration	**3 hours**
Instructions:	Attempt any 3 questions.
	All questions will be marked equally.

Requirements:
MCQ
Handout
Statistical/ Log Tables
Cambridge Tables
Graph Paper
Log Graph Paper
Other Materials

Release to Library: Yes

PTO

Q.1. i) Discuss the properties of a well designed relational schema. (6)

ii) With respect to EER diagrams, explain the term *specialisation.* Describe the different types of specialisation and propose an appropriate mapping to a relational schema for each specialisation. Use appropriate examples in your answer. (11)

iii) Given R = {A, B, C, D, E, F, G, H, I} and the following functional dependencies:
- {A,B,C} → {D, E, F}
- {A,B} → {G}
- {G} → {B}
- {C} → {H}
- {H} → {I}

decompose R to a set of relations such that all relations satisfy BCNF.
(8)

iv) Explain, with the use of an example, the meaning of the term *non-additive join.* Illustrate, with an example, how one might test if a relational schema has the *non-additive join* property. (8)

Q.2. i) What is meant by *conflict-serializability.* For either two-phase locking or timestamping, show how conflict-serializability is guaranteed. (10)

ii) Show how the following schedule would proceed under two phase locking *or* time-stamping.

Ta	Tb	Tc
		read_item(X)
		read_item(Y)
	read_item(Y)	
	read_item(Z)	
read_item(X)		
read_item(Z)		
	write_item(Y)	
		write_item(X)
write_item(Z)		

(10)

iii) Explain the recovery process for a system operating under the immediate update protocol. Suggest how the principles underlying the recovery mechanism can be extended to operate in a distributed database. (13)

PTO

Q.3. i) Given the following company database schema:

   EMPLOYEE: <u>SSN</u>, Fname, Lname, Salary, Address, Age, Dno
   DEPARTMENT: <u>Dno</u>, Dname, Description
   DEPT_LOCN: <u>Dno, DLocation</u>
   PROJECT: <u>Pno</u>, Pname, Budget, Proj_Desc, Plocation
   WORKS_ON: <u>SSN, Pno</u>, Hours

  provide an SQL query for the following:

  List all employees (Fname, Lname) who work for a department based in "Dublin" *or* who have worked more than 10 hours on a project located in "Dublin".   (4)

  Outline the process of heuristic optimisation. Develop an operator tree that represents an efficient evaluation strategy for the above query.(16)

ii) Discuss in detail the structure of a B+ tree. Explain, with the aid of an example how a B+ tree grows when new data is added. Discuss the efficiency of a B+ tree.   (13)

Q.4. i) In parallel databases, relations may be distributed in different ways. These include *round-robin based approaches, hashing based approaches* and via the use of a *partitioning vector*. Describe these approaches and discuss their suitability for different types of queries.
      (8)

ii) Given a parallel database, suggest an efficient means to execute a *sort* operation on a relation.   (9)

iii) With respect to Datalog, explain, with suitable examples, the notion of rule-safety.   (8)

iv) With a schema of your choice, show how the relational operators can be implemented in Datalog.   (8)